

LEVEL

SUSQUEHANNA RIVER BASIN
MILITARY WEST BRANCH STONEY FORK CREEK, TIOGA COUNTY

(12)

ADA097042

PENNSYLVANIA

BROWN'S LAKE DAM

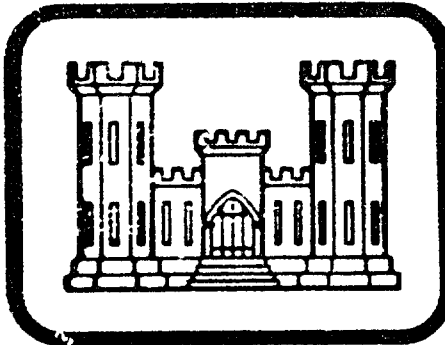
NDI ID NO. PA-516

DER ID NO. 59-68

ARLINGTON BROWN

LEVEL

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DTIC
SELECTED
APR 6 1981

DACW31-81E-0012

Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA
15931

"Original contains color
plates. All DTIC reproductions
will be in black and
white."

FOR
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

MARCH, 1981

DISTRIBUTION STATEMENT A
Approved for public release;
distribution unlimited

DTIC FILE COPY

81 4 6 083

SUSQUEHANNA RIVER BASIN
TRIBUTARY, WEST BRANCH STONEY FORK CREEK, TIOGA COUNTY

12

6

PENNSYLVANIA

National Dam Inspection Program.

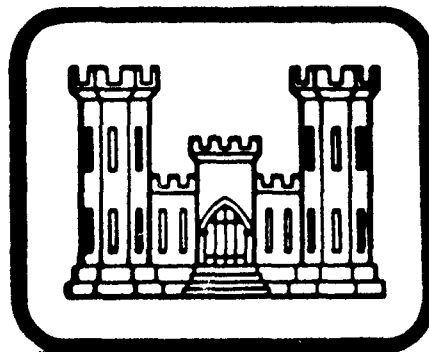
BROWN'S LAKE DAM

(ND1 ID No. PA-516,
DER ID No. 59-68).

ARLINGTON BROWN, Susquehanna River Basin
Tributary, West Branch Stoney Fork Creek, Tioga County, Pennsylvania,

PHASE I INSPECTION REPORT,

NATIONAL DAM INSPECTION PROGRAM



DTIC
ELECTED
APR 6 1981
C

16 DANC-81-0-0012

Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA

15931

10 R. Jeffrey Kimball

FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

21203

12/64

DISTRIBUTION STATEMENT
Approved for release
Distribution Statement

111 MARCH 1981

411 001

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification for <i>50 on file</i>	
By	
Distribution	
Availability Codes	
Dist	Avail and/or Special
<i>A</i>	

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM	Brown's Lake Dam
STATE LOCATED	Pennsylvania
COUNTY LOCATED	Tioga
STREAM	Unnamed tributary to the West Branch of the Stony Fork Creek
DATES OF INSPECTION	October 21, 1980 and January 15, 1981
COORDINATES	Lat: 41° 41.3' Long: 77° 23.5'

ASSESSMENT

↓

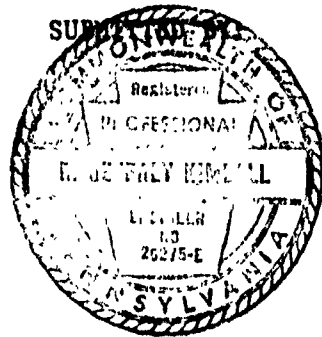
The assessment of Brown's Lake Dam is based upon visual observations made at the time of inspection, hydraulic and hydrologic computations and past operational performance. The inspection and review of data of the Brown's Lake Dam did not reveal any problems which would require emergency action. The dam appears to be in good condition and adequately maintained.

Brown's Lake Dam is a high hazard-small size dam. The spillway design flood (SDF) for a dam of this size and classification is 1/2 PMF to the PMF. The PMF has been selected as the spillway design flood based on downstream potential for loss of life. The spillway and reservoir are capable of controlling the spillway design flood (PMF). Based on criteria established by the Corps of Engineers, the spillway is termed adequate.

The following recommendations and remedial measures should be instituted as soon as possible.

1. A regularly scheduled maintenance program should be developed and implemented.
 2. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.
 3. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.
 4. The drainline valve should be operated on a regular basis.
- ↗

BROWN'S LAKE DAM
PA 516



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

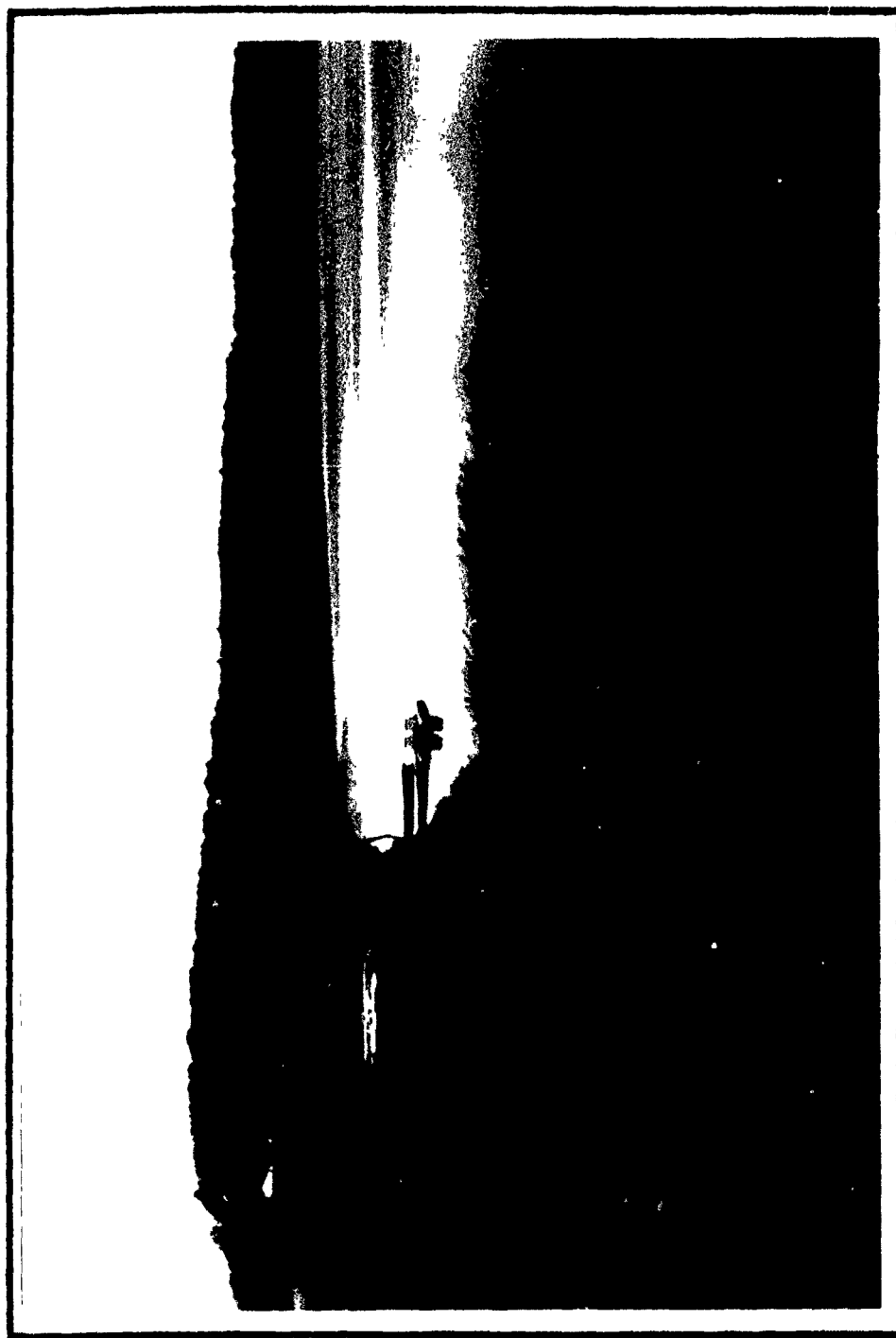
FEB. 25, 1981
Date

R Jeffrey Kimball
R. Jeffrey Kimball, P.E.

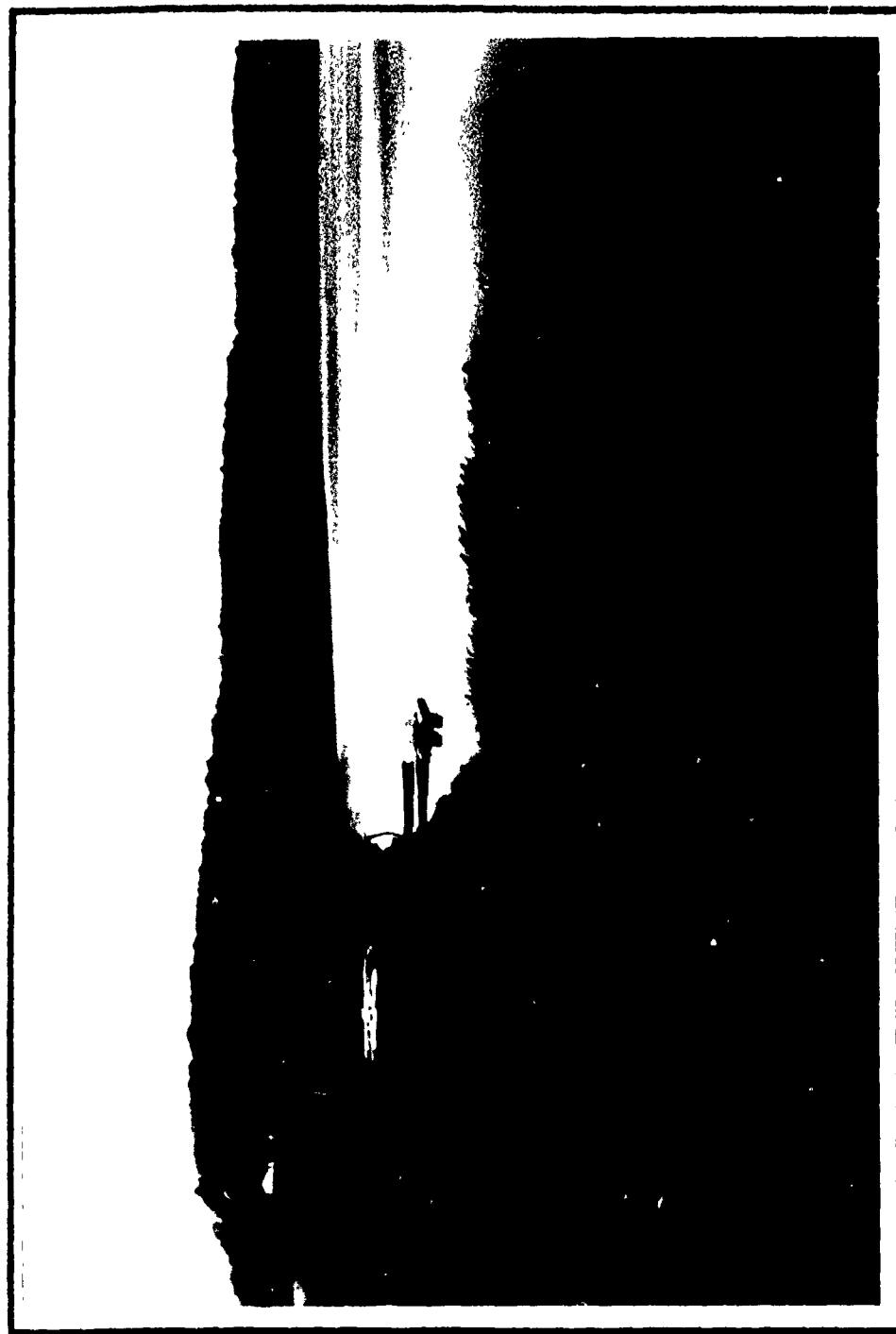
APPROVED BY:

27 MARCH 1981
Date

James W. Peck
JAMES W. PECK
COL, Corps of Engineers
District Engineer



Overview of Browns Lake Dam



Overview of Browns Lake Dam

APPENDICES

- APPENDIX A - CHECKLIST, VISUAL INSPECTION, PHASE I
- APPENDIX B - CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION,
OPERATION, PHASE I
- APPENDIX C - PHOTOGRAPHS
- APPENDIX D - HYDROLOGY AND HYDRAULICS
- APPENDIX E - DRAWINGS
- APPENDIX F - GEOLOGY

PHASE I
NATIONAL DAM INSPECTION PROGRAM

BROWN'S LAKE DAM
NDI. I.D. NO. PA 516
DER I.D. NO. 59-68

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Brown's Lake Dam is an earthfill dam, 840 feet long and 13 feet high. The crest width of the dam is 8 feet. The upstream slope is 2.5H:1V (varies) and the downstream slope 3.5H:1V. The crest of the dam and the slopes are grass covered.

The principal spillway consists of a 10" cast iron pipe, located approximately 300 feet from the left abutment. The reservoir drain discharges into the principal spillway pipe and is equipped with a 8" gate valve located on the upstream slope of the embankment. A trapezoidal emergency spillway is located at the left abutment. The bottom width of the trapezoidal section is 20 feet. The discharge channel for the emergency spillway extends along the left abutment and discharges beyond the toe of the embankment section.

b. Location. The dam is located approximately 10 miles southwest of Wellsboro, Tioga County, Pennsylvania. Brown's Lake Dam can be located on the Tiadaghton, U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Brown's Lake Dam is a small size dam (13 feet high, 84 acre-feet).

d. Hazard Classification. Brown's Lake Dam is a high hazard dam. Downstream conditions indicate that the loss of more than a few lives is probable should the structure fail. A campground office is located directly beyond the toe of the dam and several dwellings are located approximately one mile downstream of the lake. The campground office is occupied on a seasonal basis.

e. Ownership. Brown's Lake Dam is owned by Mr. Arlington Brown. Correspondence should be addressed to:

Mr. Arlington Brown
R.D. #5 Box 138
Wellisboro, PA 16901
717/724-2205

f. Purpose of Dam. Brown's Lake Dam is used for recreation.

g. Design and Construction History. The construction of Brown's Lake Dam began in 1962 and was completed in 1964. The Soil Conservation Service (SCS) designed the structure and the construction was completed by Mr. Irvin Gottschall of Beechwood, Pennsylvania.

h. Normal Operating Procedures. No operations are conducted at the dam. The principal spillway discharges normal inflow to the reservoir. The reservoir drainline was last operated approximately in 1979. The emergency spillway controls excess inflow to the reservoir during periods of flooding.

1.3 Pertinent Data.

a. Drainage Area. 0.05 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Drainline capacity at normal pool	Less than 50
Emergency spillway capacity at top of dam	220

c. Elevation (U.S.G.S. Datum) (feet). - Field survey based on an assumed principal spillway crest elevation of 1840 feet, obtained from U.S.G.S. 7.5 minute quadrangle.

Top of dam - low point	1843.2
Maximum pool - design surcharge	Unknown
Normal pool	1840.0
Emergency spillway crest	1841.2
Principal spillway crest (estimate)	1840.0
Downstream invert (drainline)	1829.9
Maximum tailwater	None
Toe of dam	1829.9
Pool at time of inspection	1839.3

d. Reservoir (feet).

Length of maximum pool (PMF)	850
Length of normal pool	800

e. Storage (acre-feet).

Normal pool (principal spillway crest)	51
Top of dam	84

f. Reservoir Surface (acres).

Top of dam	16
Normal pool	15
Principal spillway crest	15

g. Dam.

Type	Earthfill
Length	840
Height	13 feet
Top width	8 feet
Side slopes - upstream	2.5H:1V (varies)
- downstream	3.5H:1V
Zoning	Unknown
Impervious core	Unknown
Cutoff	Unknown
Grout curtain	Unknown

h. Reservoir Drain.

Type	8" cast iron pipe
Length (approximate)	75 feet
Closure	Gate valve
Access	Upstream slope
Regulating facilities	Valve with stem on upstream slope

i. Principal spillway.

Type	10" cast iron pipe
Length	Approximately 75 feet
Crest elevation	1840

j. Emergency Spillway.

Type	Trapezoidal
Length (bottom width)	20 feet
Crest elevation	1841.2
Upstream channel	Lake (unrestricted)
Downstream channel	Earth spillway exit channel
Discharge channel	Natural streambed

SECTION 2
ENGINEERING DATA

2.1 Design. No information was available in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources regarding the Brown's Lake Dam. Based on an interview with the owner, Mr. Arlington Brown, it was reported that the dam was designed by the Soil Conservation Service. No other information is available regarding the design of the structure.

2.2 Construction. Construction of Brown's Lake Dam began in 1962 and was completed approximately in 1964. The owner, Mr. Arlington Brown, reported that the dam was constructed by Mr. Irvin Gahshall, Beachwood, Pennsylvania. No other information is available on construction of the dam.

2.3 Operation. No operations are conducted at the dam.

2.4 Evaluation.

a. Availability. No engineering data exists in the Pennsylvania Department of Environmental Resources, Bureau of Dams and Waterway Management file. The owner of the dam is Mr. Arlington Brown. The owner reported that the dam was designed by the Soil Conservation Service.

b. Adequacy. The Phase I report was based on visual inspection and hydrologic and hydraulic analysis. Sufficient information exists to complete a Phase I Report.

SECTION 3 VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Brown's Lake Dam was conducted by personnel of L. Robert Kimball and Associates on October 21, 1980 and January 15, 1981. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portion of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in good condition and well maintained. From a brief survey conducted during the inspection, it was noted that a low spot exists on the embankment crest approximately 100 feet from the right abutment. The survey indicated that the low spot on the embankment crest was a localized condition.

The crest of the dam and the upstream and downstream slopes are grass covered. The crest width is 8 feet. The upstream slope of the dam was measured to be 2.5H:1V and the downstream slope was 3.5H:1V.

An emergency spillway exists at the left abutment of the embankment section. The spillway slopes and channel are grass covered. No obstructions were observed at the emergency spillway approach or in the downstream channel.

c. Appurtenant Structures. The principal spillway for the reservoir consists of a 10" cast iron pipe with an 8" drainline. A gate valve exists on the upstream end of the 8" drainline and is controlled by a valve stem on the upstream slope of the embankment. The principal spillway crest was assumed to be 1840.0 feet based on the U.S.G.S. 7.5 minute quadrangle.

d. Reservoir Area. The watershed consists entirely of open fields. The watershed and reservoir slopes are very gentle and are not susceptible to massive landslides which would affect the storage volume of the reservoir or cause overtopping of the dam by displacing water.

e. Downstream Channel. The downstream channel of the Brown's Lake Dam is relatively narrow and discharges from the dam flow into the west branch of the Stony Fork Creek. Approximately two homes (8 people) exist within one mile of the dam.

3.2 Evaluation. The embankment appeared to be in good condition and well maintained. The principal spillway appeared to be in fair condition and the drainline was reported operated approximately one year ago (1979). No signs of seepage or erosion were observed during the inspections. The emergency spillway appeared to be in good condition and no obstructions were observed at the spillway approach or in the discharge channel.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The water level is maintained at the principal spillway crest elevation, 1840.0.

4.2 Maintenance of the Dam. No planned maintenance schedule exists for the Brown's Lake Dam. Maintenance of the dam is conducted on an unscheduled, as-needed basis.

4.3 Maintenance of Operating Facilities. No operations are conducted at the dam. It was reported by the owner, Mr. Arlington Brown, that the drainline was operated approximately one year ago (1979).

4.4 Warning System in Effect. No warning system exists for the Brown's Lake Dam.

4.5 Evaluation. The condition of the dam is considered good. There was no warning system in effect to warn downstream residents of large spillway discharges or imminent failure of the dam. An emergency action plan should be available for every dam in the high and significant categories. Such plans should outline actions to be taken by the operator to minimize downstream effects of an emergency and should include an effective warning system. Such an emergency plan does not exist for the Brown's Lake Dam and the owner should develop such an action plan.

No regular maintenance program exists at the dam. A regularly scheduled program should be prepared and implemented. The maintenance program should include operating the drainline on a regular basis.

SECTION 5 HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. No information pertaining to the hydraulic and hydrologic design calculations were available for review. It was reported by Mr. Arlington Brown, that the dam was designed by the Soil Conservation Service.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillways reportedly have functioned adequately in the past.

c. Visual Observations. The spillways appeared to be in good condition. A localized low spot exists on the embankment crest approximately 100 feet from the right abutment. It was observed during the inspection that filling the low spot would not significantly affect the hydrologic and hydraulic analysis associated with the structure. No erosion or seepage were observed during the inspection.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to make the following assumptions.

1. Pool elevation prior to the storm was at the emergency spillway crest elevation, 1841.2.
2. The top of dam was considered the low spot elevation, 1843.2.
3. The discharge potential of the principal spillway was not considered in the analysis.

5.3 Summary of Overtopping Analysis. Complete summary sheets for the computer output are presented in Appendix D.

Peak inflow (PMF)	325 cfs
Spillway capacity	220 cfs

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for a dam of this size and classification is in the range of 1/2 PMF to PMF. The spillway design flood for this dam was selected to be the PMF based on the downstream potential for loss of life. Based on the following definition provided by the Corps of Engineers, the spillway is rated as adequate as a result of our hydrologic analysis.

Adequate - All high hazards dams which pass the spillway design flood (PMF).

The spillway and reservoir are capable of controlling the PMF without overtopping the embankment.

5.4 Summary of Dam Breach Analysis. As the subject dam is capable of passing the spillway design flood (PMF) it was not necessary to perform the dam breach analysis and downstream routing of the flood wave.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. No erosion or seepage were observed during the inspection. No structural deficiencies were observed during the time of inspection and the embankment appeared to be in good condition.

b. Design and Construction Data. No design or construction data were available for review. It was reported by the owner, Mr. Arlington Brown, that the dam was designed by the Soil Conservation Service. Construction on the dam began in 1962 and was completed approximately 1964. No information was available relative to the construction of the dam. The dam was constructed by Mr. Irvin Gottschall, a contractor from Beechwood, Pennsylvania.

c. Operating Records. No operations are conducted at the dam.

d. Post Construction Changes. No post construction changes are known to have occurred since the structure was completed in 1964.

e. Seismic Stability. The dam is located in seismic zone 1. No known seismic stability analyses have been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. No signs of instability were noted during the inspection.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in good condition and adequately maintained. No erosion or seepage were observed during the inspection. The visual observation, review of available data, hydrologic and hydraulic calculations and past operational performance indicate that the Brown's Lake Dam is capable of controlling the spillway design flood (PMF).

b. Adequacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations listed below are of minor nature and should be implemented as soon as possible.

d. Necessity for Further Investigation. No further investigations are required.

7.2 Recommendations/Remedial Measures.

1. A regularly scheduled maintenance program should be developed and implemented.

2. A warning system should be developed to warn downstream residents of large spillway discharges or imminent failure of the dam.

3. A safety inspection program should be implemented with inspections at regular intervals by qualified personnel.

4. The drainline valve should be operated on a regular basis.

APPENDIX A
CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Brown's Lake Dam COUNTY Tioga STATE Pennsylvania ID# PA 516

TYPE OF DAM Earthfill HAZARD CATEGORY High 45°

DATE(s) INSPECTION October 21, 1980 25°

January 15, 1981 WEATHER Seasonal TEMPERATURE

POOL ELEVATION AT TIME OF INSPECTION 1839.3 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball, P.E. - L. Robert Kimball and Associates

James T. Hockensmith - L. Robert Kimball and Associates

O.T. McConnell - L. Robert Kimball and Associates

O.T. McConnell RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Appears all right.	
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Crest and slopes are grass covered.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Appears to be good.	
ANY NOTICEABLE SEEPAGE	None.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	None.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	Not applicable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not applicable.	
DRAINS	Not applicable.	
WATER PASSAGES	Not applicable.	
FOUNDATION	Not applicable.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not applicable.	
STRUCTURAL CRACKING	Not applicable.	
VERTICAL AND HORIZONTAL ALIGNMENT	Not applicable.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	Not applicable.	
STAFF GAUGE OR RECORDER	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Not applicable.	
INTAKE STRUCTURE	10" cast iron pipe with trash rack.	
OUTLET STRUCTURE	8" cast iron pipe.	
OUTLET CHANNEL	Small ditch beyond toe of downstream slope.	
EMERGENCY GATE	Gate valve with stem on upstream slope of dam.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Not applicable.	
APPROACH CHANNEL	Unrestricted trapezoidal channel at left abutment.	
DISCHARGE CHANNEL	Trapezoidal to natural stream.	
BRIDGE AND PIERS	None.	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Unnamed tributary to the West Branch of the Stony Fork Creek. No obstructions or debris observed.	
SLOPES	Appear to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 2 homes - 8 people within one mile of the dam.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle.	
SEDIMENTATION	Unknown.	

INSTRUMENTATION

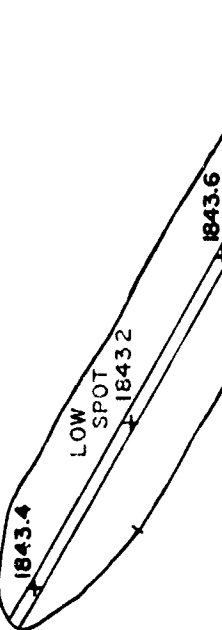
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



1843.8
+

POOL
ELEV. 1839.3

LOW
SPOT
1843.2



PRINCIPAL SPILLWAY
CREST 1840.0
10" PIPE
VALVE

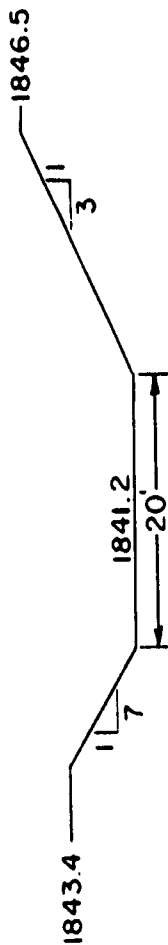
FLOW

INVERT 1829.9
8" cast iron pipe

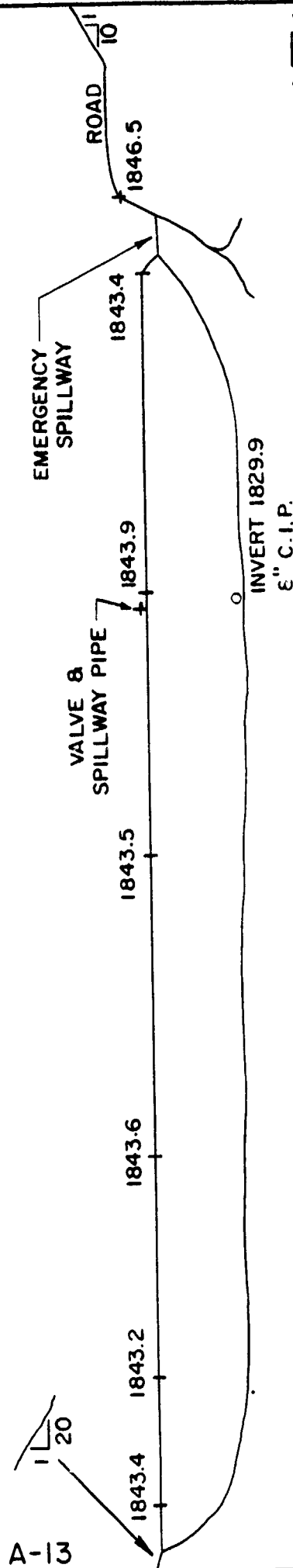
PCAD



BROWN'S LAKE DAM
SCALE: 1"=100'



EMERGENCY SPILLWAY PROFILE
LOOKING UPSTREAM
(NOT TO SCALE)



PROFILE
LOOKING UPSTREAM
HORIZ. 1"=100'
SCALE: VERT. 1"=20'

BROWN'S LAKE DAM



APPENDIX B
CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Brown's Lake Dam

ID# PA 516

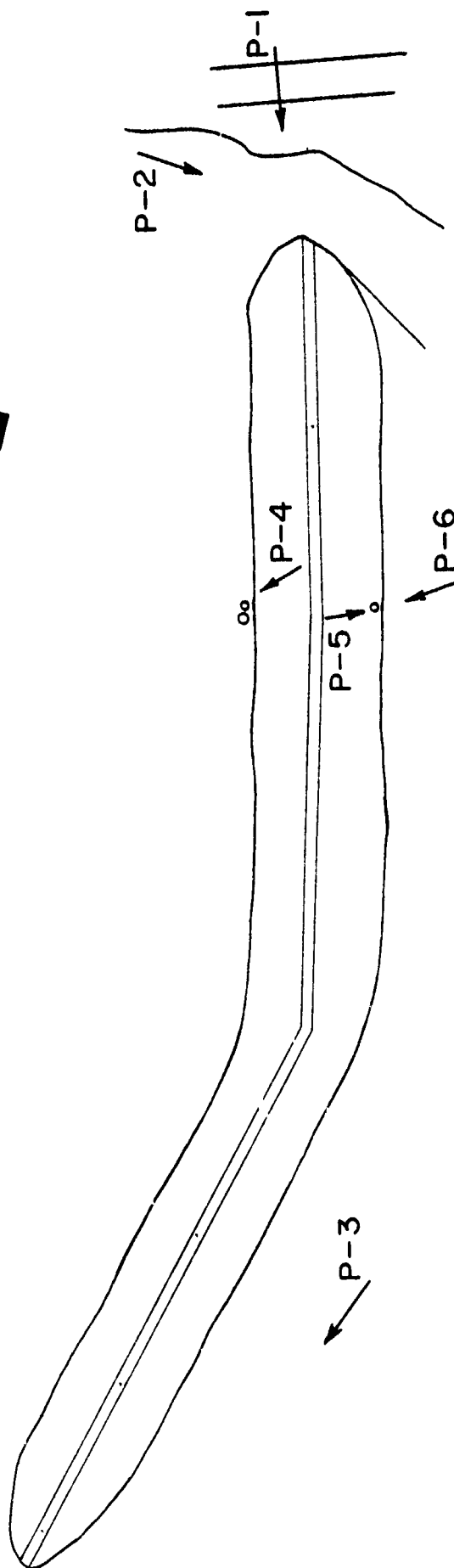
ITEM	REMARKS
AS-BUILT DRAWINGS	Unknown.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle.
CONSTRUCTION HISTORY	Owner interviewed.
TYPICAL SECTIONS OF DAM	None.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	None. None. None. None. None.

ITEM	REMARKS
DESIGN REPORTS	Not available for review.
GEOLOGY REPORTS	Unknown.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Unknown.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Unknown.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Unknown.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None known.
HIGH POOL RECORDS	Unknown.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None.
MAINTENANCE OPERATION RECORDS	None available.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None available for review.
OPERATING EQUIPMENT PLANS & DETAILS	None.

APPENDIX C
PHOTOGRAPHS



C - 1



BROWN'S LAKE DAM PHOTO INDEX

P - INDICATES PHOTO LOCATION

BROWNS LAKE

Sheet 1

Front

- (1) View of embankment crest, upstream and downstream slopes. Note the emergency spillway channel in the foreground. View from the left abutment.
- (2) Emergency spillway approach and discharge channel.
- (3) View of downstream slope and area immediately beyond the toe. View towards the right abutment.
- (4) Intake structure and control valve stem on upstream slope.

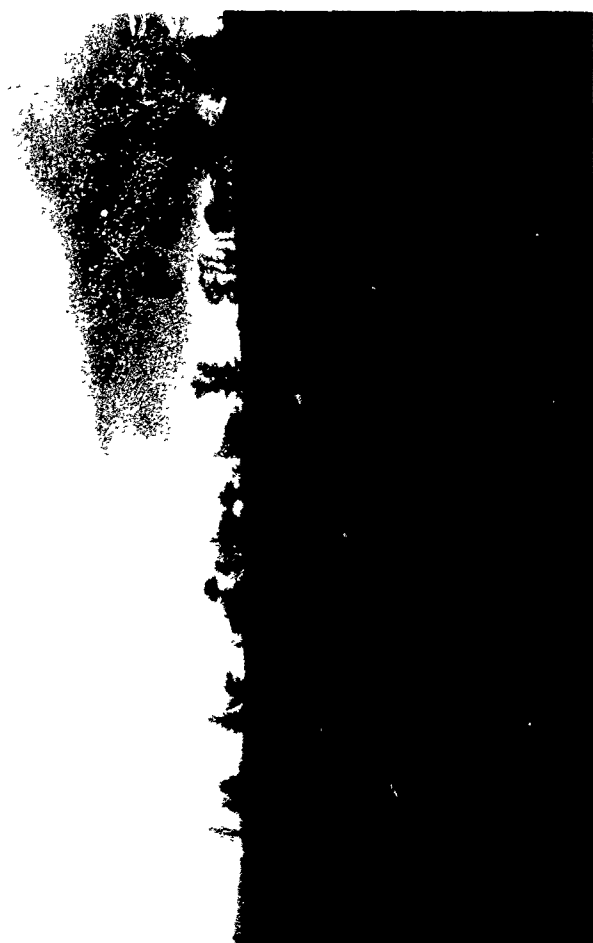
Sheet 1

Back

- (5) View of drainline discharge channel.
- (6) View of the discharge outlet at the toe of the downstream slope.

TOP OF PAGE

1,5	2,6
3	4





APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Report No. 40" prepared by the U.S. Weather Bureau.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
Ct	Coefficient representing variations of watershed	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topographic
Lca	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
Cp	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimeted from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre-failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.

HYDROLOGY AND HYDRAULICS ANALYSIS DATA BASE

NAME OF DAM: Brown's Lake Dam

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.2 (1.00)= 22.2

STATION	1	2	3
---------	---	---	---

Station Description	Brown's Lake Dam
---------------------	------------------

Drainage Area (square miles)	0.05
---------------------------------	------

Cumulative Drainage Area (square miles)	0.05
--	------

Adjustment of PMF for Drainage Area (%) (1)	
6 hours	117
12 hours	127
24 hours	136
48 hours	143
72 hours	N/A

Snyder Hydrograph Parameters :	
Zone (2)	17
Cp (3)	0.45
Ct (3)	1.13
L (miles) (4)	0.30
Lca (miles) (4)	0.095
tp = Ct(LxLca) 0.3 hrs.	0.39

Spillway Data (Emergency spillway)	
Crest Length (ft)	20 (bottom width)
Freeboard (ft)	2.0
Discharge Coefficient	C'=0.95
Exponent	N/A

- (1) Hydrometeorological Report 40 (Figure 1), U.S. Weather Bureau & U.S. Army Corps of Engineers, 1965.
- (2) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's coefficients (Cp and Ct).
- (3) Snyder's Coefficients.
- (4) L=Length of longest water course from outlet to basin divide.
Lca=Length of water course from outlet to point opposite the centroid of drainage area.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.05 sq.mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1841.2 [63 ac-ft]

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1843.2[84 ac-ft]

ELEVATION MAXIMUM DESIGN POOL: Unknown

ELEVATION TOP DAM: 1843.2

SPILLWAY CREST: (Emergency Spillway)

a. Elevation	<u>1841.2</u>
b. Type	<u>Trapezoidal</u>
c. Width	<u>20 feet</u>
d. Length	<u>Approximately 100'</u>
e. Location Spillover	<u>Left abutment</u>
f. Number and Type of Gates	<u>None</u>

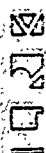
OUTLET WORKS:

a. Type	<u>8" CIP</u>
b. Location	<u>Approximately 200 feet from left abutment</u>
c. Entrance inverts	<u>Unknown</u>
d. Exit inverts	<u>1829.9</u>
e. Emergency drawdown facilities	<u>8" drainline</u>

HYDROMETEOROLOGICAL GAUGES:

a. Type	<u>None</u>
b. Location	<u>None</u>
c. Records	<u>None</u>

MAXIMUM NON-DAMAGING DISCHARGE: Unknown



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME BROWN'S LAKE DAM
NUMBER PA
SHEET NO. 1 OF 3
BY OTM DATE 12/30

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY THE BALTIMORE DISTRICT
CORPS OF ENGINEERS.

STRTL = 1 INCH
CNSTL = 0.05 IN./HR.
STRTO = 1.5 CFS./MI.²
QRC SN = 0.05 (5% OF PEAK FLOW)
RTIOE = 2

ELEVATION - AREA - CAPACITY RELATIONSHIP

FROM U.S.G.S. 7.5-MIN. QUAD, PENN. DIST. FILE 3 AND
FIELD INSPECTION DATA.

FROM THE SPILLWAY CREST ELEV. 1340'
SURFACE AREA AT ELEV. 1340' IS 15.3 ACRES
MINIMUM CREST ELEV. = 84 ACRES

FROM THE U.S.G.S. 7.5-MIN. QUAD, PENN. DIST. FILE 3 AND
FIELD INSPECTION DATA (HEC-1), DAM
SAFETY VERSION (USE 3 MIN. JN.),

$$H = 31/A \quad \text{WHERE } H = 10.1 \text{ FT}$$

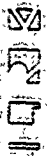
$$Y = AH/3$$

$$= (15.3 \text{ ACRES})(10.1 \text{ FT})/3$$

$$= 51.5 \text{ ACRES (NORMAL POOL SURFACE)}$$

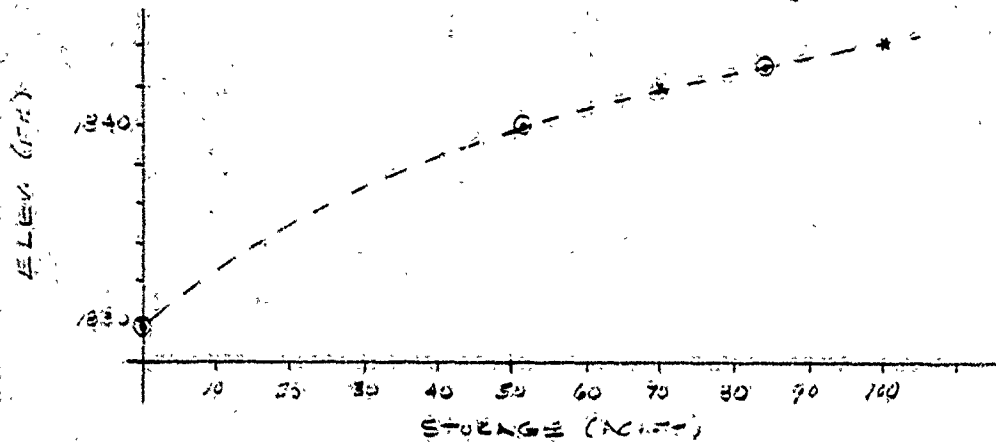
NOTE: $H = (\text{NORMAL POOL ELEV.}) - (\text{TOE OF DAM ELEV.})$
 $= 1340.0 - 1329.9$
 $= 10.1 \text{ FEET}$

STORAGE (ACRES)	0	51.5	70	84	100
ELEV. (FT)	1327.7	1340	1342	1343.2	1344.2

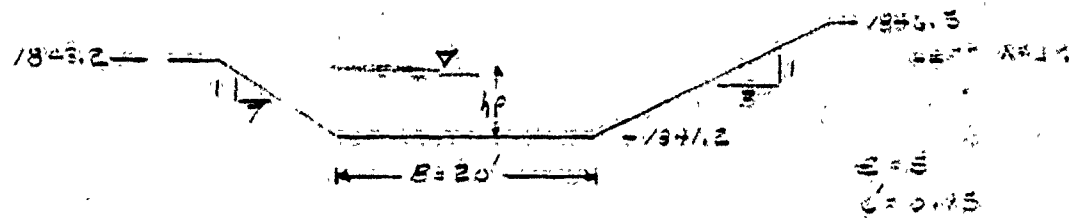


L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME _____
 NUMBER _____
 SHEET NO. 2 OF 3
 BY OTM DATE 12/80



DISCHARGE RATING



EMERGENCY SPILLWAY PROFILE
 VIEWING UPSTREAM
 NOT TO SCALE

From: $Q = 8.05 C' h_v^{1/2} (h_p \cdot h_v) [B + z (h_p \cdot h_v)]$

where $h_v = \frac{3(2z h_p + B) \cdot (16z^2 h_p^2 + 16z B h_p + 75z^2)}{10z}$

WATER AND WASTEWATER ENGINEERING (11-A) & (11-B)
 by FAIR, GIER & OKUM, 1966

LOW DAMS, Eq. (7) & (8)
 by NATIONAL RESOURCES COMMITTEE,
 WASHINGTON, D.C. 1953



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

NAME _____
NUMBER PA-

SHEET NO. 3 OF 3
BY OTM DATE 12/30

ELEVATION (FT.)	1/2 (FT.)	* DISCHARGE = Q (cfs)
1841.0	0	0
1841.5	0.3	10
1842.0	0.8	50
1842.5	1.3	110
1843.0	1.8	190
1843.2	2	220

OVERTOPPING PARAMETERS

TOP OF DAM (LOW SPILL ELEVATION) = 1843.2
LENGTH OF DAM (EXCLUDING SPILLWAY) = 840 FT.
COEFFICIENT OF DISCHARGE (C) = 2.9

 FLOOD HYDROGRAPH PACKAGE (HRC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 01 APR 80

1	A1	ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMR									
2	A2	HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BROWN'S LAKE DAM									
3	A3	RATIOS OF PMR ROUTED THROUGH THE RESERVOIR (DER ID NO. 59-68)									
4	R	200	0	5	0	0	0	0	0	0	-4
5	U1	5	0	0	0	0	0	0	0	0	0
6	J	1	3	1							
7	J1	0	0	1							
8	K	0	0	1							
9	K1	INFLOW									
10	M	1	1	0.052							
11	P	22.2	117	136							
12	T										
13	W	0.39	0.45								
14	X	-1.5	-0.05	2.0							
15	K	1	2								
16	K1	ROUTE THRU BROWN'S LAKE									
17	V										
18	V1	1									
19	Y41041.2	1041.5	1042	1042.5	1043	1043.2					
20	Y5	0	10	170	190	220					
21	SS	0	51.5	70	84	100					
22	SE1029.9	1040	1042	1043.2	1044.2						
23	SE1041.2										
24	SD1043.2	2.9	1.5	040							
25	K	99									

 RECORD HYDROGRAPH PACKAGE (HRC-1)
 DAN SAFETY VERSION JULY 1978
 LEAST MODIFICATION 01 APR 80

RUN DATE# 81/01/22
 TIME# 07.47.58

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF BROWN'S LAKE DAM
 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR (IDEN ID NO. 59-68)

JOB SPECIFICATION

TD	HR	DAIS	TDAY	THR	THIN	MTTC	IPLT	IPRT	NSTAN
28	0	5	0	0	0	0	0	0	0
JOPE		NPT		LRPT	TRACE				
5		0		0	0				

MULTI-PLAN ANALYSES TO BE PERFORMED
 #PLAN= 1 HRTIO= 3 ERTIO= 1

RTIOS= .50 .70 1.00

SUB-AREA RUNOFF COMPUTATION

INFLOW

ISTAG	ICOMP	IFCOR	ITAPE	JPLT	JPRE	TRAIL	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPHIC DATA

HYDG	THUS	TAREA	SHAP	TRSDA	TRSPC	RATIO	ISNOW	ISAM	LOCAL
1	1	.05	0.00	.05	1.00	0.000	0	0	0

PRECIP DATA

SITE	PH5	R6	R12	R24	R5H	R72	R96
0.00	22.20	117.00	177.00	136.00	0.00	0.00	0.00

LOSS DATA

LOPI	STOR	DETR	RTOL	ESCH	STKS	RIOR	STIR	COST	ALSM	RTMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.05	0.00	0.00

UJET HYDROGRAPHIC DATA

10= 29 CP= 69 NIA= 0

REGRESSION DATA
ORCS= 1.00

R1OP= 2.00

ONLY HYDROGRAPH 3 EMP-OF-PERIOD-ORDINATES LAG= 29 INCHES CP= 69 VOL= 1.00

3.	12.	24.	34.	38.	36.	31.	28.	24.	21.
19.	16.	14.	13.	11.	10.	8.	7.	6.	6.
5.	4.	4.	3.	3.	3.	2.	2.	2.	2.
1.	1.	1.	1.	1.	1.	1.	1.	0.	0.

0.00 DA IN-PM P-1000 RAIN EXCS LOSS
 0.0 0.0 0.0
 END-OF-PERIOD FLOW
 COMP 0.0 0.0 0.0
 0.00 DA IN-PM P-1000 RAIN EXCS LOSS
 0.0 0.0 0.0
 END-OF-PERIOD FLOW
 COMP 0.0 0.0 0.0

HYDROGRAPHIC ROUTING

ROUTE THROUGHOUTS CASE

STAGE	1841.20	1841.50	1842.00	1842.50	1843.00	1843.20	1843.40	1843.60	1844.00	1844.40	1844.80	1845.20	1845.60	1846.00	1846.40	1846.80	1847.20	1847.60	1848.00	1848.40	1848.80	1849.20	1849.60	1850.00
FLOW	0.00	10.00	50.00	110.00	190.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00	220.00
CAPACITY	0.0	52.0	70.0	84.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

STAGE 1841.20 1841.50 1842.00 1842.50 1843.00 1843.20 1843.40 1843.60 1844.00 1844.40 1844.80 1845.20 1845.60 1846.00 1846.40 1846.80 1847.20 1847.60 1848.00 1848.40 1848.80 1849.20 1849.60 1850.00

FLOW 0.00 10.00 50.00 110.00 190.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00 220.00

CAPACITY 0.0 52.0 70.0 84.0 100.0

PEAK OUTFLOW IS 97.0 AT TIME 16.75 HOURS
 PEAK OUTFLOW IS 143.0 AT TIME 16.67 HOURS
 PEAK OUTFLOW IS 210.0 AT TIME 16.50 HOURS

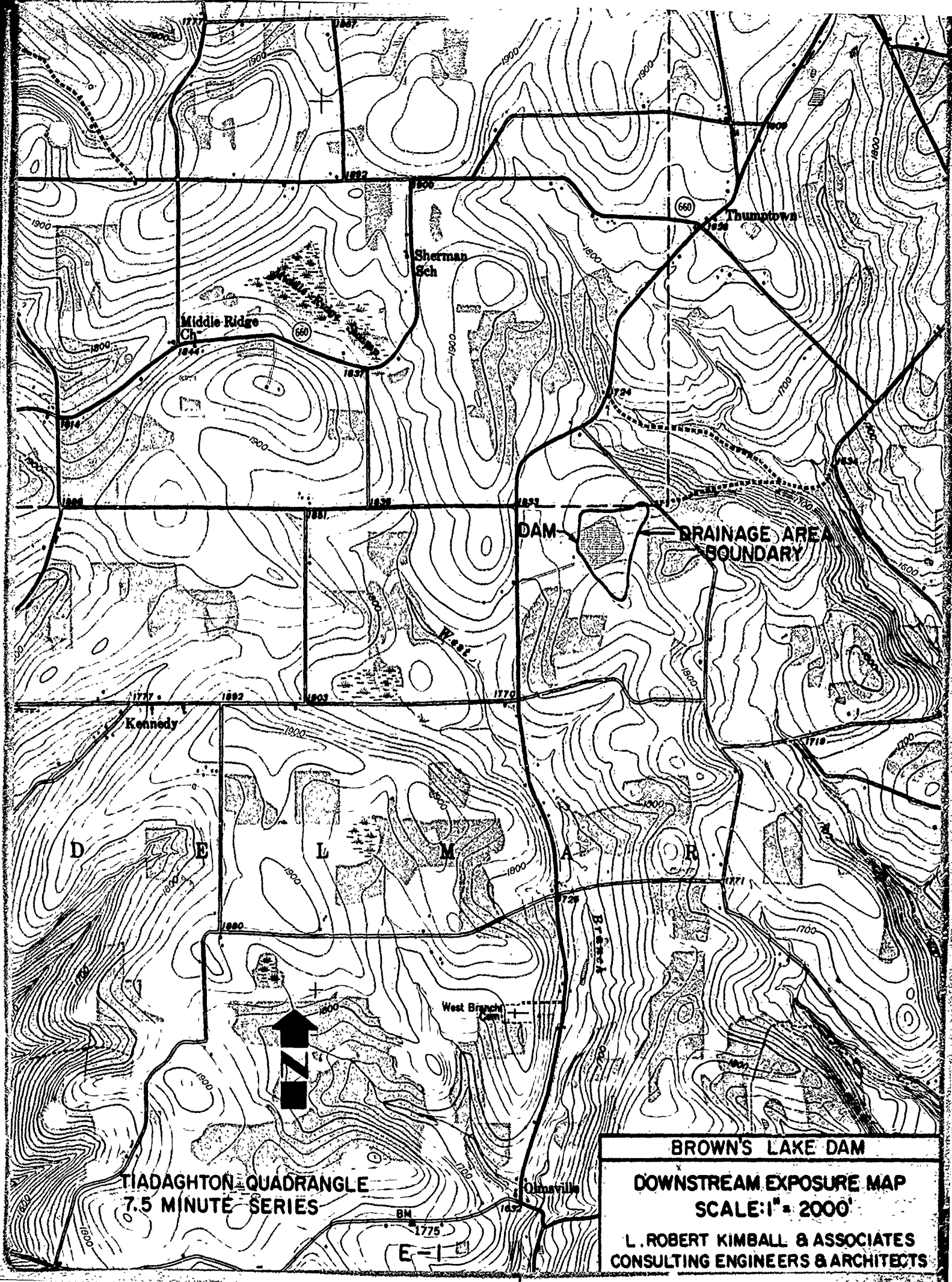
PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS		
				RATIO 1	RATIO 2	RATIO 3
				.50	.70	1.00
HYDROGRAPH AT	1	.05	1	163	228	325
	(.13)	(4.61)(6.45)(9.22)(
ROUTED TO	2	.05	1	97	143	210
	(.13)	(2.74)(4.04)(5.96)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		ELEVATION	INITIAL VALUE	SPILLWAY CRIST	TOP OF DAM	
		STORAGE	1841.20	1841.20	1843.20	
		OUTFLOW	63.	63.	84.	
			0.	0.	220.	
RATIO OF PPE	MAXIMUM RESERVOIR W.S. LEVEL	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS
0.50	1842.39	0.00	75.	97.	0.00	16.
0.70	1842.70	0.00	78.	143.	0.00	16.
1.00	1843.14	0.00	83.	210.	0.00	16.

APPENDIX E
DRAWINGS

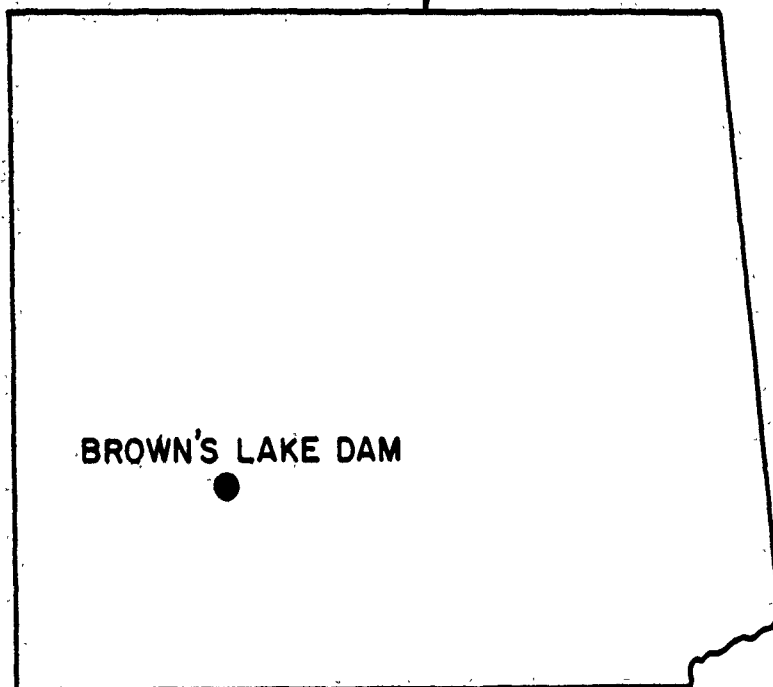
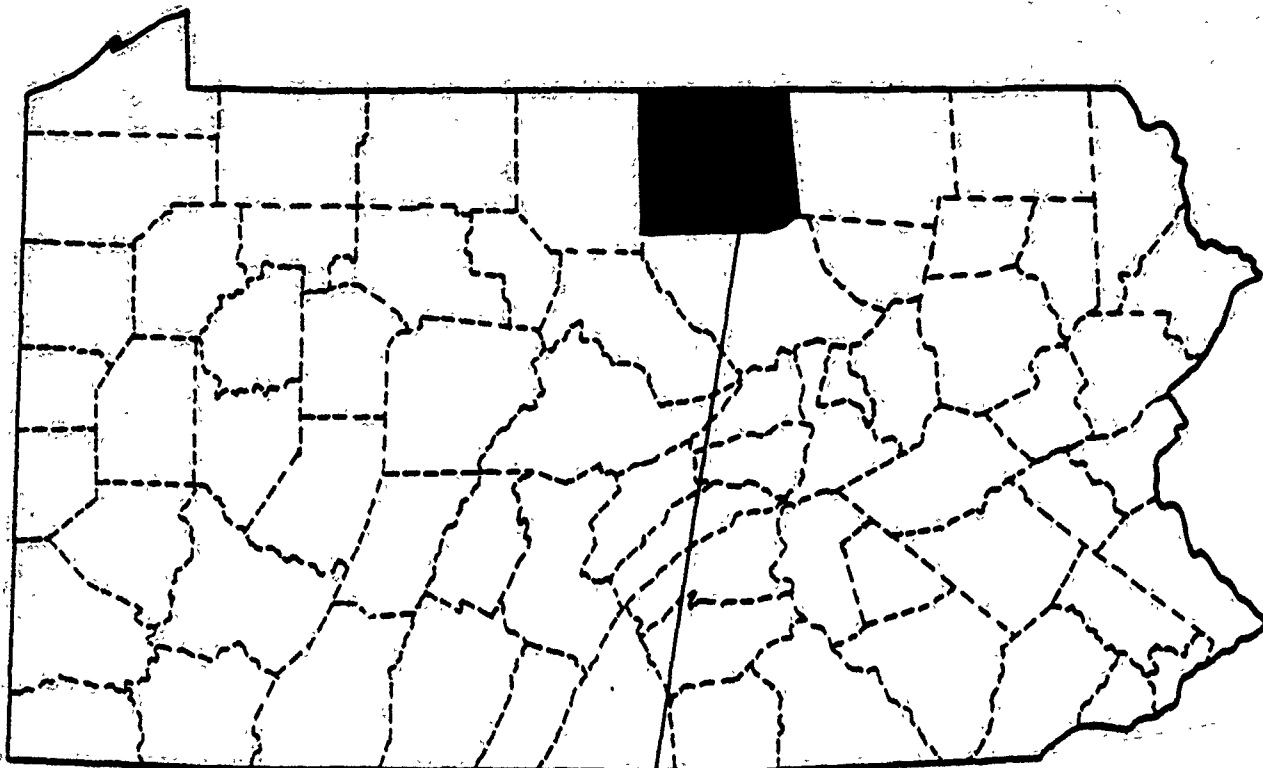


TIADAGHTON QUADRANGLE
7.5 MINUTE SERIES

BROWN'S LAKE DAM

DOWNSTREAM EXPOSURE MAP
SCALE: 1" = 2000'

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



SITE LOCATION MAP
TIOGA COUNTY, PENNSYLVANIA

APPENDIX F
GEOLOGY

General Geology

The Brown's Lake Dam is located in the (Glaciated) Low Plateaus of the Appalachian Plateaus Province. The topography in this area is characteristic of the folded portion of the Plateaus province, once covered by the Wisconsin glacier which left prominent glacial features in the valleys, leaving few in the uplands. The glacial lake and stream deposits are the most productive water-bearing materials in this area. The bedrock underlying these surface deposits consists mainly of red shales, with interbedded red and brown sandstone of the Catskill Formation of Upper Devonian age.

Structurally, the Brown's Lake Dam is located along the axis of the Wellsboro Anticline where it plunges to the southwest. The Pine Creek Syncline lies to the northwest and the Blossburg Syncline lies to the southeast of the study area. These three structural features portray the regional trend to the east-northeast of a series of well-defined folds. The strike of the strata is northeast-southwest in the vicinity of Brown's Lake Dam. Surface evidence of faulting has been observed in the past on the Wellsboro Anticline southeast of Wellsboro.



GEOLOGIC MAP OF AREA AROUND BROWN'S LAKE DAM.
SCALE 1:250,000

DEVONIAN

UPPER

CENTRAL AND EASTERN PENNSYLVANIA



Osgo Formation

Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses includes red shales which become more numerous eastward. Relation to type Osgo not proved.



Catskill Formation

Chiefly red to brownish shales and sandstones includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shohola, and Delaware River in the east.



Marine beds

Gray to olive brown shales, graywackes, and sandstones, contains "Chemung" beds and "Portage" beds including Buckel, Balthie, Hurrell, and Trimmers Rock, Tully Limestone at base.



Susquehanna Group

Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey. County reports, barbs on "Chemung" side of line.